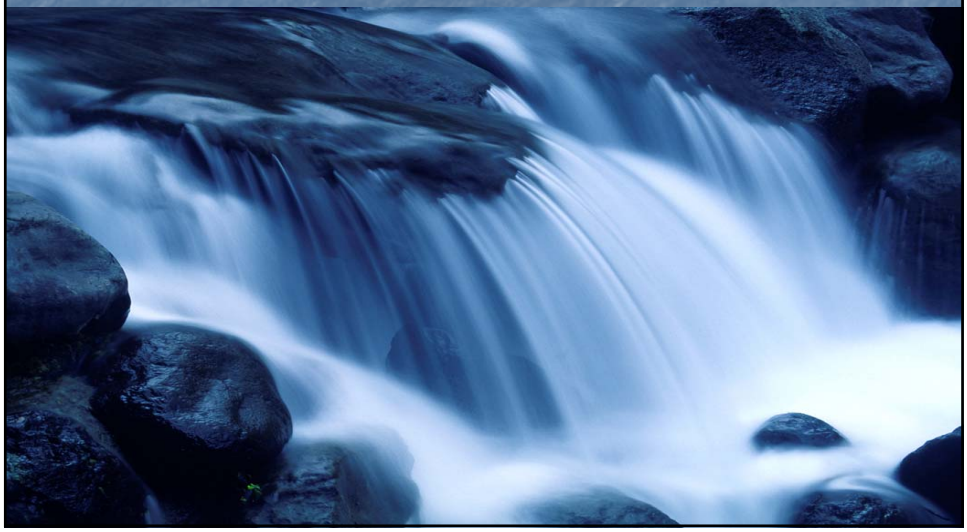
Developing a Water Quality Monitoring Program



Overview

- What is CWA § 106?
- Monitoring Strategy
- Selection of Sampling Sites
- Determining how Data will be Collected

CWA §106 Grant Program

- Funding available to Federally recognized Indian Tribes to administer a water quality environmental program
- Funds can be used for the following:
  - Water Quality planning, assessments and studies
  - Ambient Monitoring
  - Community Outreach and Education
  - Surface, ground, and source water protection
  - Various other activities

Why Do We Want to Improve Water Quality?

- Maintain the natural habitat for wildlife, native plants, and for those in your community
- Support the designated uses of that waterbody (fishable, swimmable, etc)
- Protect and maintain the cultural significance
- Protect drinking water (health concern)
- Esthetically pleasing

Why Monitor Water Quality?

- Characterize waterbodies
- Ensure water quality is maintained/improved
- Identify existing or emerging water quality problems
- Identify changes or trends over time
- Determine fate and transport of pollutants
- To address water quality problems
- Measure effectiveness of efforts to improve water quality

Building a Monitoring Program

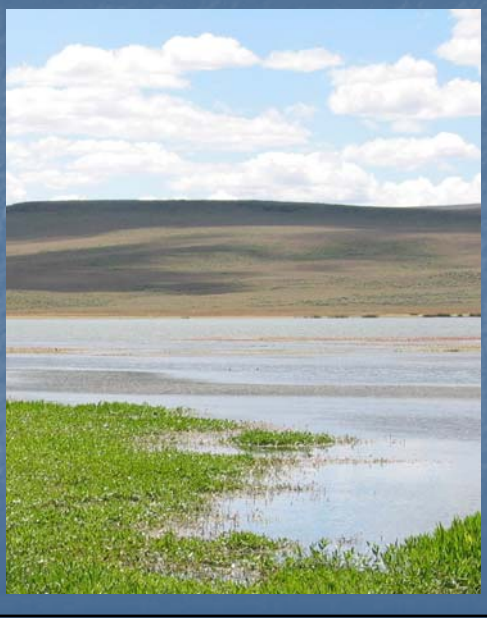
- Develop a Monitoring Strategy
- Establish Baseline Monitoring Program
- Develop Standard Operating Procedures
- Develop QAPPs
- Collect Data
- Analyze Monitoring Samples
- Use Monitoring Results

Description of Monitoring Strategy

- An implementation plan that describes how an environmental program will improve water quality
  - Strategies vary across tribal programs
  - Include program needs, goals, & objectives
    - How monitoring program serves water quality management needs and addresses tribal waters over time
  - Identify methodology & sampling parameters
  - Include data analysis, data storage and reporting procedures
  - Allows for overall program evaluation

Components of a Monitoring Strategy

1. Monitoring Objectives
2. Monitoring Design
3. Water Quality Indicators
4. Quality Assurance Project Plan
5. Data Management Procedures
6. Data Analysis and Assessment
7. Reporting Procedures
8. Program Evaluation / Needs Planning



Components of a Monitoring Strategy

1. Monitoring Objectives
   - Narrative describing the major goal(s) and measurable objectives of the monitoring program
     - Surface water, spring, & ground water monitoring programs
     - Identifying NPS impacts
     - Use of sound, scientific data for water quality and water resources decision making
     - Measuring effectiveness of an implementation project
     - Maintenance and protection of pristine reservation waters
     - Any other examples?

Components of a Monitoring Strategy

2. Monitoring Design
   - A description of the program's approach for selecting sampling sites to serve overall goals and objectives
     - **Design factors**: sampling design as reflected in sampling locations, frequency, schedule
     - **Considerations**: existing data, physical setting & processes, regulatory boundaries, areas of interest, constraints

Site No.	Location	Rational for Selection
SW-1	Shady Creek, entrance to Reservation	Provides baseline info on WQ before entering Reservation; provides means for identifying pollution sources on or off Reservation

Components of a Monitoring Strategy

2. Monitoring Design (cont.)
   - **Site selection:** location of potential point & nonpoint sources & tributaries; representative of surface water flow & aquifer
   - **Sampling frequency:** sufficient to build on existing data; fill gaps in data or missing constituents
   - **WQ Indicators:** adequately characterize WQ, meet Tribe needs, & intended data uses
   - **Sampling Schedule:** reflects different flow conditions & seasons

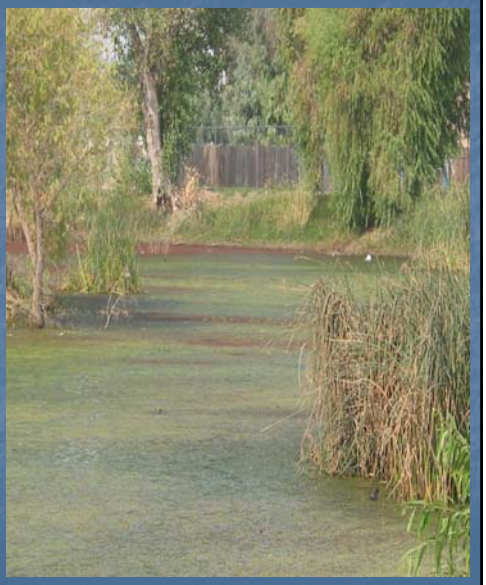
Site No.	Location	Rational for Selection
SW-2	Shady Creek, slightly downstream from SW-1	Collect influence from unnamed wash & from industrial plant, both located upstream of site to help determine if they are contributing pollutants, after comparison with SW-1 data

Components of a Monitoring Strategy

3. Water Quality Indicators (WQI)
   - Define the core set of WQI or parameters that will be measured to help meet program goals and objectives
   - Required WQIs per the CWA §106 Guidance
     - pH, Temperature, Dissolved Oxygen, Turbidity, Total Phosphorus, Total Nitrogen, Bacterial Indicators, Macroinvertebrates, Basic Habitat Information
   - Rank & Select WQIs
     - Representative, repeatable, cost, understandable results, effective measurement of goals, easy to implement, early warning of environmental change

Monitoring Strategy Wrap-Up

- Per the CWA §106 Guidance, Monitoring Strategies are now *REQUIRED*
- Once a Monitoring Strategy is written, it may not need to be revised unless the goals and objectives change within a program
- Comprehensive monitoring strategies help tribes understand existing water quality conditions, which is a key step in protecting and improving water quality



Establish A Baseline Monitoring Program

- Understand EPA's reporting requirements
- Determine monitoring frequency of each WQI/parameter
- Select Monitoring Sites
- Determine how monitoring data will be used and displayed

Fundamental Reporting Parameters

	Ecological Impacts	Causes of Impairment	Data Collection
Dissolved Oxygen (DO)	Sensitive species weaken, move away, or die	Changes in water temperature, levels of organic material	Kits, probes, meters
pH	Allows toxic elements and compounds to become mobile	Acid rain, mining, wastewater discharges	Kits, probes, meters
Temp.	Influences rate of photosynthesis by aquatic plants; metabolic rates of aquatic organisms; and sensitivity of aquatic organisms to toxic wastes, parasites, and diseases	Weather, removal of riparian shade, dams/barriers, industrial discharges, stormwater runoff	Thermometers, probes, meters
Turbidity	Raises water temperature, lowers DO, clogs fish gills, smother fish eggs and macroinvertebrates, changes physical structure of habitat	Eroding stream banks, wastewater discharge, urban runoff, farming and forestry practices, excessive algae growth	Lakes: Secchi disk, kits, probes, meters Streams: Turbidity tube, kits, probes, meters

Intermediate Reporting Parameters

	Ecological Impacts	Sources	Data Collection
Total Phosphorus	Algae blooms, accelerated plant growth, low dissolved oxygen	Soil/rocks, wastewater discharge, runoff from lawn fertilizer, cropland, and animal manure, disturbed land areas, drained wetlands, water treatment, decomposing organic matter, commercial cleaning preparations	Kits, probes, or meters, contract laboratory
Total Nitrogen	Low dissolved oxygen, types of plants & animals in waterbody	Wastewater discharge, runoff from lawn fertilizer, cropland, and animal manure runoff, failing septic systems, industrial discharges	Kits, probes, or meters, or contract laboratory

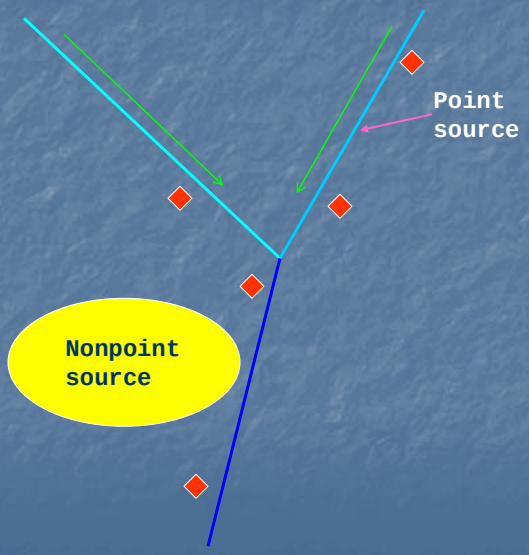
Mature Reporting Requirements

- Macroinvertebrates
  - Indicator of biological integrity of waterbody
    - Determines types of stressors affecting waterbody
    - Number of species in waterbody compared to indices to determine health of stream
  - Different methods of measurement
    - Manual counting
    - Laboratory conducted population analyses
- *E. coli* or enterococci
  - Indicator of presence of pathogens in drinking and recreational waters
    - If present, fishing and swimming may cause health risks
  - Causes cloudy water, unpleasant orders, increased oxygen demand (reducing levels of DO)
  - Sources: wastewater discharge, septic systems, stormwater runoff, animal manure runoff
- Basic Habitat Information
  - Physical attributes of a waterbody and surrounding area
  - Human degradation of aquatic habitat major cause of water quality impairment

Selecting Water Sampling Sites

- Considerations
  - Water Quality Program Goals and Objectives
  - Types of data needed
  - Equipment needs
  - Sampling methods
- Obtain all available historical information
- Consider physical characteristics of the area
  - Size and shape of drainage basin
  - Land use
  - Tributary and runoff characteristics
  - Geology
  - Point and nonpoint sources of contamination
  - Hydraulic conditions
  - Climate
  - Water depth
  - Fluvial-sediment transport characteristics
- Consider chemical and biological characteristics of the area

Sample site selection



Field Work Preparation

- Understand the purpose for which the various types of data will be collected and the system (i.e., waterbody) that each sample should represent
- Review the study workplan, especially types of measurements and samples needed
- Make field reconnaissance trips before selecting sampling sites
- Note conditions that could affect sampling operations
  - Seasonal high or low streamflow
  - Site-access peculiarities
  - Flowing wells
- Evaluate potential sources of contamination at the site
- Review site files and data
  - Site location, description, and access
  - Previously collected physical, chemical, and biological data
- Obtain and keep current with training and the laboratory requirements associated with data-collection activities

Sample Collection Methods

- Grab or Dip sample
- Composite sample
  - Time composite
  - Flow composite
- Flow integrated sample
- Point sample (specific location or depth)
- End-of-pipe sample (point sources)
- Continuous sampling (probe measurements)

Quality Control Samples

- **Blank samples**
  - Samples of water known to be free of target analytes
  - Used to identify potential sources of contamination and to evaluate magnitude of contamination with respect to the concentration of the target analytes
- **Replicate samples**
  - Environmental samples collected in duplicate, triplicate…, and are considered to be identical in composition
  - Used to identify/quantify variability from sample collection, processing, and analysis procedures
- **Spikes (MS/MSD)**
  - Environmental samples spiked with known concentrations of target analytes
  - Uses to assess recoveries from field matrices and assist in evaluating precision of results for range of target analytes in different matrices
- **Reference samples**
  - Samples with known concentrations of target analytes
  - Used to assess variability and bias associated with processing, shipping, and analysis

Develop Standard Operating Procedures

- Decide when and how often samples will be collected
- Develop proper procedures for sample collection, storage, preservation, tracking, chain of custody, QA, and analysis
- Develop SOPs
  - To achieve consistency and uniformity when performing tasks
  - Describe procedures for sampling equipment maintenance and calibration
  - Procedures for every parameter being monitored

Developing QAPPs

- Document that outlines procedures that a monitoring project will use to ensure that the samples collected and analyzed, the data stored and managed, and the reports produced are of sufficient quality to meet project needs
- QAPPs cover monitoring, data management, and data analysis and assessment activities

Analyze Monitoring Samples Using Outside Laboratories

- Samples sent to outside laboratory if in-house expertise or equipment not available
  - Can be expensive
  - Presents logistical problems (getting samples to lab on time)
- Develop SOPs to document how samples shipped to laboratories are tracked, including chain-of-custody procedures and procedures for field crews to follow when collecting, transferring, storing, and shipping samples

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